

## HITCH DEVICE FOR ATTACHING FARM IMPLEMENTS TO A TRACTOR

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### BACKGROUND OF INVENTION

#### Field of Invention.

The present invention relates to a front axle of an agricultural tractor.

#### Background of Prior Art.

10 The present invention relates to a hitch device for attaching farm implements to a tractor.

More specifically, the present invention relates to a so-called “three-point hitch device”, to which the following description refers purely by way of example.

15 In the farm machinery industry, a three-point hitch device is known for attaching farm implements to a tractor, and which normally comprises two bottom lift arms, to which the implement is connected in rotary manner to oscillate about a given hinge axis; and a top actuating cylinder interposed between the tractor frame and the implement to control the angular position of the implement about the hinge axis.

20 Each lift arm is moved by a further actuating cylinder interposed between the tractor frame and the lift arm itself, and having an output rod defining, inside the further actuating cylinder, two chambers, each of which is connected to a feed line of a hydraulic circuit supplying pressurized fluid to and from the chambers.

The hydraulic circuit comprises a slide valve located along the feed lines

and movable selectively between a closed position and three open positions closing and opening the feed lines respectively. In two of the open positions, one of the two feed lines communicates hydraulically with a pump supplying fluid to the relative chamber, and the other communicates hydraulically with a fluid tank;  
5 and, in the third open position, both feed lines communicate hydraulically with the tank.

The hydraulic circuit also comprises a lock valve interposed between the feed lines and relative chambers to keep the output rod in a given position when the slide valve is in the closed position.

10 A major drawback of known hitch devices of the above type is that, when the slide valve is moved to the third open position, the lock valve must be operated to connect both chambers hydraulically to the tank. Moreover, operation of the lock valve is relatively complex and not very precise.

It is an object of the present invention to provide a hitch device for  
15 attaching farm implements to a tractor, designed to eliminate the aforementioned drawbacks.

## **SUMMARY OF THE INVENTION**

According to the present invention, there is provided a hitch device for attaching farm implements to a tractor, the device comprising two lift arms for  
20 supporting at least one farm implement; an actuating cylinder for each lift arm, the actuating cylinder having an output rod defining two chambers inside the actuating cylinder; and a circuit for feeding a fluid to and from said chambers; characterized in that said circuit comprises, for each said chamber, two feed lines for feeding said fluid to and from the chamber respectively, and also comprises

four independent valves; each valve being located along one of said feed lines, and being movable between a closed position and at least one open position respectively closing and opening the relative said feed line.

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## **BRIEF DESCRIPTION OF THE DRAWINGS**

A non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a schematic view in perspective of a preferred embodiment of the hitch device according to the present invention;

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Figure 2 shows schematically, with parts enlarged for clarity, a hydraulic circuit employed in the Figure 1 hitch device;

Figure 3 shows a first variation of the Figure 2 hydraulic circuit;

Figure 4 shows a second variation of the Figure 2 hydraulic circuit.

## **DETAILED DESCRIPTION OF THE INVENTION**

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Number 1 in Figure 1 indicates as a whole a hitch device for attaching a known farm implement (not shown), such as a plough, to a tractor 2.

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Device 1 is normally referred to as a “three-point hitch device”, and comprises two bottom lift arms 3, which are connected in rotary manner to a frame 4 of tractor 2 by the interposition, for example, of a spherical joint (not shown), and are oscillated, with respect to frame 4 and by respective actuating cylinders 5, about respective substantially horizontal axes 6 of rotation (only one shown in Figure 1).

The free end of each arm 3 has a supporting hook 7, which cooperates with hook 7 of the other arm 3 to support the implement (not shown), which is

connected in rotary manner to hooks 7 to oscillate, with respect to hooks 7, about a hinge axis 8. The angular position of the implement (not shown) about axis 8 is controlled by a top actuating cylinder 9, which is connected in rotary manner to frame 4 by the interposition, for example, of a spherical joint (not shown), and  
5 comprises an output rod 10, the free end of which has a supporting hook 11 for engaging the implement (not shown).

With reference to Figure 2, rod 10 defines, inside cylinder 9, two chambers 12, which communicate hydraulically with a hydraulic circuit 13 supplying pressurized fluid, and one of which (hereinafter indicated 12a) has a  
10 larger cross section than the other (hereinafter indicated 12b).

Circuit 13 comprises a fluid tank 14; a feed pump 15 – in the example shown, a known piston pump – for drawing fluid from tank 14; and, for each chamber 12a, 12b, two feed lines 16, 17 for feeding fluid respectively to and from chamber 12a, 12b. Lines 16, 17 of each chamber 12a, 12b comprise a portion 18  
15 common to both lines 16, 17 and connected hydraulically to relative chamber 12a, 12b; and two respective portions 19, 20, of which, portion 19 is a feed portion connected hydraulically to pump 15, and portion 20 a drain portion connected hydraulically to tank 14.

Each portion 19, 20 also communicates hydraulically with relative portion  
20 18 by the interposition of a proportional electromagnetic valve 21, 22, which is movable, under the control of an electronic central control unit 23, between a closed position (hereinafter indicated “O”) closing relative portion 19, 20, and an open position (hereinafter indicated “I”) opening relative portion 19, 20.

In actual use, central control unit 23 selectively controls valves 21, 22 of

cylinder 9 independently, so that:

When valves 21, 22 of chamber 12a are in the open “T” and closed “O” position respectively, and valves 21, 22 of chamber 12b are in the closed “O” and open “T” position respectively, chambers 12a, 12b communicate with pump 15  
5 and tank 14 respectively, and rod 10 of cylinder 9 moves from a withdrawn position to an extracted position;

When valves 21, 22 of chamber 12a are in the closed “O” and open “T” position respectively, and valves 21, 22 of chamber 12b are in the open “T” and closed “O” position respectively, chambers 12a, 12b communicate with tank 14  
10 and pump 15 respectively, and rod 10 of cylinder 9 moves from the extracted position to the withdrawn position; and

When valves 21, 22 of chamber 12a are in the closed “O” and open “T” position respectively, and valves 21, 22 of chamber 12b are also in the closed “O” and open “T” position respectively, both chambers 12a, 12b communicate with  
15 tank 14, and rod 10 of cylinder 9 floats as determined by the farm implement (not shown).

Cylinder 9 also comprises a detecting device 24 connected to central control unit 23 and for controlling the position of rod 10 along cylinder 9; and two pressure transducers 25 also connected to central control unit 23 and for  
20 determining the pressure in respective chambers 12a, 12b and, therefore, the force exerted in use on rod 10.

In actual use, central control unit 23 selectively controls operation of all the valves 21, 22 of cylinder 9 as a function of the signals from device 24 and/or transducers 25, so as to operate cylinder 9 as follows:

When central control unit 23 only takes into account the signals from device 24, and excludes the signals from transducers 25, valves 21, 22 of cylinder 9 are operated to move rod 10 into, and then maintain, a given position stored in central control unit 23;

5           When central control unit 23 only takes into account the signals from transducers 25, and excludes the signals from device 24, valves 21, 22 of cylinder 9 are operated to move rod 10 so that the force exerted on rod 10 by the implement (not shown) is maintained substantially constant and equal to a given value; and

10           When central control unit 23 takes into account the signals from both device 24 and transducers 25, valves 21, 22 of cylinder 9 are operated to move rod 10 within a given range of positions stored in central control unit 23, and to keep the force exerted on rod 10 by the implement (not shown) substantially constant and equal to a given value.

15           Each cylinder 5 is connected in rotary manner to frame 4 by the interposition, for example, of a spherical joint (not shown), and comprises an output rod 26 connected in articulated manner at the free end to relative arm 3, and which defines, inside cylinder 5, two chambers 27 communicating hydraulically with circuit 13, and one of which (hereinafter indicated 27a) has a  
20   larger cross section than the other (hereinafter indicated 27b).

For each chamber 27a, 27b of each cylinder 5, circuit 13 comprises two feed lines 28, 29 for feeding fluid respectively to and from chamber 27a, 27b. Lines 28, 29 of each chamber 27a, 27b comprise a portion 30 common to both lines 28, 29 and connected hydraulically to relative chamber 27a, 27b; and two

respective portions 31, 32, of which, portion 31 is a feed portion connected hydraulically to pump 15, and portion 32 a drain portion connected hydraulically to tank 14.

Each portion 31, 32 also communicates hydraulically with relative portion 30 by the interposition of a proportional electromagnetic valve 33, 34, which is movable, under the control of central control unit 23, between a closed position (hereinafter indicated "O") closing relative portion 31, 32, and an open position (hereinafter indicated "I") opening relative portion 31, 32.

Each cylinder 5 also comprises a detecting device 35 connected to central control unit 23 and for controlling the position of rod 26 along cylinder 5; and two pressure transducers 36 also connected to central control unit 23 and for determining the pressure in respective chambers 27a, 27b and, therefore, the force exerted in use on rod 26.

Valves 33, 34 of each cylinder 5 operate in exactly the same way as described for valves 21, 22 of cylinder 9, and therefore require no further explanation.

In connection with the above, it should be pointed out that:

The implement (not shown) is lowered when rods 26 are moved simultaneously from the withdrawn to the extracted position;

The implement (not shown) is raised when rods 26 are moved simultaneously from the extracted to the withdrawn position;

The implement (not shown) is maintained in a given position when valves 33, 34 of cylinders 5 are all in the closed "O" position;

The implement (not shown) is moved about an axis of oscillation (not

shown) substantially perpendicular to axis 8, when one of rods 26 is maintained in a given position and the other is moved between the withdrawn and extracted positions, and also when one of rods 26 is moved from the withdrawn to the extracted position, and the other from the extracted to the withdrawn position;

5           The implement (not shown) floats freely on the ground when valves 34 are all in the open “I” position, and valves 33 are all in the closed “O” position; and

          The angular position of the implement (not shown) about axis 8 is controlled selectively by operation of cylinder 9.

          The Figure 3 variation differs from Figure 2 solely by piston pump 15  
10       being replaced by a feed assembly 37 comprising a gear pump 38 for drawing fluid from tank 14; a drain line 39 for draining pump 38 into tank 14; and a compensating valve 40, which is located along line 39, is normally set to an open position opening line 39, and is moved by central control unit 23 into a closed position closing line 39 when fluid is to be fed by pump 38 to valves 21 and/or 33.

15           The Figure 4 variation differs from Figures 2 and 3 solely by piston pump 15 and feed assembly 37 being replaced by a feed assembly 41 comprising a piston pump 42 for drawing fluid from tank 14; a gear pump 43 also for drawing fluid from tank 14; a drain line 44 for draining pump 43 into tank 14; and a connecting line 45 connecting pumps 42 and 43.

20           Assembly 41 also comprises a compensating valve 46 located along line 45 and normally set to a closed position closing line 45; and a drain valve 47 located along line 44 and normally set to an open position opening line 44. In actual use, when fluid is to be fed by pump 42 to valves 21 and/or 33, central control unit 23 moves valve 46 into an open position opening line 45, so that



pump 43 supplies fluid to pump 42, and valve 47 is moved into a closed position closing line 44.

Pressure transducers 36 therefore provide for directly controlling the forces exerted, in use, on hitch device 1, with no need for additional control  
5 devices specially designed for the purpose. In which connection, it should be pointed out that pressure transducers 25 are auxiliary with respect to pressure transducers 36.